

Remarks

Claims 87-157 are pending.

Claims 87, 89, 113-122, 140, 146, 148, and 151 have been amended. Support for the amendments is in the figures and specification at page 2, line 14 to page 3, line 6, and page 11, line 19 to page 12, line 7.

New Claims 154-157 have been added. Support for the claims is in the pending claims, and the specification at page 11, line 19 to page 12, line 7.

No new matter has been added with the amendments or the addition of the new claims. The scope of the claims is intended to be the same after the amendment as it was before the amendment.

Objections to Claims

The Examiner objected to Claims 140 and 146 (antecedent basis).

Claims 140 and 146 have been amended as suggested by the Examiner. Accordingly, withdrawal of the objections to the claims is respectfully requested.

Rejection of Claims under 35 U.S.C. § 102(e) (Houle)

The Examiner rejected Claims 87-90, 108, 111, 122-123, 135-137, 140-141, 146-148 and 149-151 under Section 102(e) as anticipated by US 2004/0095727 (Houle).

This rejection is respectfully traversed.

The Examiner maintains that Houle discloses each of the elements recited in the claims, citing to FIG. 3a.

The Examiner is error.

Houle is directed to improvements to a heat spreader. Houle particularly teaches attaching the standoff to the surface of the heat spreader. Houle further teaches that the standoffs are merely in contact with the backside of a die – not attached to the die.

See at paragraphs [0024], [0026] and [0027] (emphasis added).

[0024] A heat spreader, comprising a metal body with attached standoffs located approximately above the integrated circuit, is described. ...

[0026] FIG. 3a illustrates both a device-side view of a heat spreader 301a, and a cross-section of a semiconductor package 309a in accordance with an embodiment of the present invention.. The heat spreader 301a has small standoffs 302a attached to the cavity-side surface...

[0027] In one embodiment, the standoff may be stamped onto the surface of the heat spreader. ...*The standoffs should be positioned so that they will contact areas on the backside of the "flip chip" integrated circuit 304a* when the package is assembled. In this embodiment, the heat spreader 301a is further constructed of copper. In another embodiment, the heat spreader 301a may be constructed of some other type of heat conducting material, such as aluminum, magnesium or ceramic.

Houle does not teach or suggest Applicant's methods as claimed – in which a standoff is formed on a surface of a die. Rather, Houle specifically teaches attaching standoffs to a heat spreader – and not to a die.

Accordingly, withdrawal of this rejection is respectfully requested.

Rejection of Claims under 35 U.S.C. §§ 102(b) (Chiu)

The Examiner rejected Claims 87-90 and 92-94 under Section 102(b) as anticipated by US 2003/0183909 (Chiu). This rejection is respectfully traversed.

The Examiner maintains that Chiu discloses each of the elements recited in the claims, citing to FIGS. 4-6.

The claims have been amended to clarify that the standoff is exposed and formed on only part of the die surface.

Chiu does not teach a "standoff" on a die. Chiu teaches *filling a gap between* a microelectronic device and a heat dissipation device that is *situated over the device*. The gap is filled with a thermal interface material that *covers the entire back surface* of the device. See at paragraphs [0029] and *FIGS. 5 and 7* showing the package.

[0026] A base portion 122 of a heat dissipation device 124 is *disposed over a back surface 126* (generally opposing said microelectronic device active surface 104) *of the microelectronic device 102....*

[0029] As shown in FIG. 4, a dispensing device 152, such as a needle, is inserted in the inlet 136. A thermal interface material 154 is dispensed through the dispensing device 152 and into the gap 146 where capillary action draws the thermal interface material 154 toward edges 156 of the microelectronic device 102, as shown in FIG. 5. Preferably, the feed rate of the thermal interface material 154 is slow enough to spread laterally by capillary action only, which creates a wetted and void-free interface. *The thermal interface material 154 is fed until into the gap 146 until it covers the entire microelectronic device back surface 126.*

FIG. 5

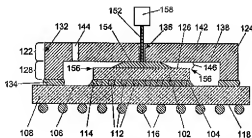
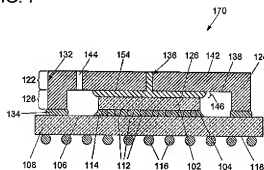


FIG. 7



Chiu does not teach or suggest Applicant's method of forming a semiconductor device by providing a die with a standoff that is *exposed* and formed on only *part* of the surface of the die. Rather, Chiu teaches a gap fill material 154 covering the *entire* surface 126 of a device 102, and which is covered by and attached to a heat dissipation device 124.

Accordingly, withdrawal of this rejection is respectfully requested.

Rejection of Claims under 35 USC § 103(a) (Houle)

The Examiner rejected Claims 109-110 and 138-139 under Section 103(a) as obvious over Houle. This rejection is respectfully traversed.

Claim 109 *depends from Claim 108* – which recites that the standoff is in the form of an *enclosure* – with the heat sink material situated *within the enclosure*. Claims 138-139 depend from *Claim 137* – which likewise recites that the standoff is in the form of an *enclosure*.

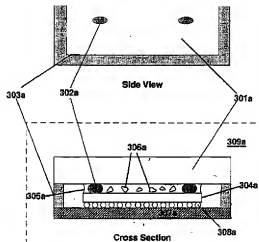
108. The method of Claim 89, wherein the *standoff is in the form of an enclosure*, and the method further comprises disposing a heat sink material on the surface of the die within the standoff enclosure.

137. A method of fabricating a semiconductor die, comprising the steps of:
forming at least one standoff on a surface of the die, *the standoff being in the form of an enclosure*; and
forming a heat sink within the standoff enclosure.

As discussed above, Houle does not teach or suggest Applicant's methods as claimed – in which a standoff is formed on a surface of a die. Rather, Houle specifically teaches attaching standoffs to a heat spreader – and *not* to a die. Nor does Houle teach or suggest a standoff structured as an *enclosure with a heat sink material within the standoff enclosure* as recited in the claims.

Rather, Houle teaches discrete standoffs **302a** – which are attached to the surface of a heat spreader **301a**. See paragraph [0026] and FIG. 3a below (emphasis added):

[0026] FIG. 3a illustrates both a device-side view of a heat spreader **301a**, and a cross-section of a semiconductor package **309a** in accordance with an embodiment of the present invention.. The heat spreader **301a** has small standoffs **302a** attached to the cavity-side surface...



Houle does not teach or suggest a standoff structured as an *enclosure with a heat sink material within the standoff enclosure* as recited in the claims. Accordingly, withdrawal of this rejection is respectfully requested.

Rejection of Claims under 35 USC § 103(a) (Houle with Dolbear)

At paragraph 8, the Examiner rejected Claims 92-95, 104, 125-127 and 134 under Section 103(a) as obvious over Houle in view of USP 5,926,371 (Dolbear). This rejection is respectfully traversed.

The Examiner cites Dolbear as teaching standoffs 58a-58c composed of epoxy adhesive, resin or plastic dispensed by molding injection, etc., citing particularly to Fig. 3 and col. 11, line 58 to col. 12, line 20.

The Examiner's interpretation of Dolbear is in error.

Dolbear teaches attaching spacers **58a-c** to a substrate using an epoxy adhesive. Dolbear does not teach dispensing a flowable material onto a die to form a standoff. See at col. 12, lines 14-17 (emphasis added).

...Spacers 58a-c are dispersed about the periphery of the upper surface of substrate 42 and firmly attached to the upper surface of substrate 42 using, for example, an epoxy adhesive. ...

Furthermore, *neither* Houle nor Dolbear teaches attaching a standoff to a die. As discussed above, Houle specifically teaches attaching standoffs to a heat spreader. And Dolbear teaches attaching spacers 58a-c to a substrate 42. See Dolbear at col. 10, lines 51-54 and FIG. 3 (emphasis added):

In the embodiment of FIGS. 2 and 3, three spacers 58a-c are dispersed about the periphery of the upper surface of substrate 42 surrounding the central region of substrate 42 in which chip 40 is mounted....

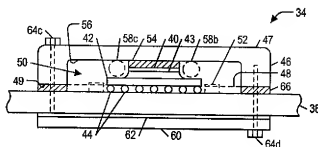


FIG. 3

See also the claims of Dolbear, for example, Claim 1 (emphasis added):

1. A heat transfer apparatus transferring heat energy from a chip mounted to a substrate, the heat transfer apparatus comprising:
a thermally conductive cap structure;
at least one spacer engaged between respective surfaces of the cap structure and a region of the substrate laterally outside a perimeter of the chip such that a space is formed between the cap structure and the chip;

The added disclosure of Dolbear does not correct the deficiencies in Houle in teaching or suggesting Applicant's method as claimed. Accordingly, withdrawal of this rejection is respectfully requested.

Rejection of Claims under 35 USC § 103(a) (Houle with Sylvester)

At paragraph 9, the Examiner rejected Claims 142-145 under Section 103(a) as obvious over Houle in view of USP 6,847,527 (Sylvester). This rejection is respectfully traversed.

The Examiner cites to Sylvester as teaching a substrate analogous to the materials recited in the claims – i.e., a polyimide film or a rigid material (a polymer material, ceramic material, metal clad fiber board, metal leadframe), stating that it would be obvious to use such materials in

Houle's device. The Examiner cites particularly to substrate 58 of Sylvester, and also the entire col. 5.

As discussed above, Houle specifically teaches attaching standoffs to a heat spreader. The added disclosure of Sylvester does not correct the deficiencies in Houle in teaching or suggesting Applicant's method as claimed.

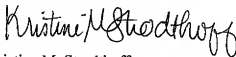
Accordingly, withdrawal of this rejection is respectfully requested.

Extension of Term. The proceedings herein are for a patent application and the provisions of 37 CFR § 1.136 apply. Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that Applicant has inadvertently overlooked the need for a petition for extension of time. If any extension and/or fee are required, please charge Account No. 23-2053.

Excess Claims Fee. If any fees are due for the added claims, please charge Account No. 23-2053.

It is submitted that the present claims are in condition for allowance, and notification to that effect is respectfully requested.

Respectfully submitted,



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